REMARKS/ARGUMENTS

Favorable consideration of the present application, in light of the above amendment and following discussion, is respectfully requested.

Claims 15, 18, 20 and 21 are pending in the present application. Claim 15 having been amended and Claims 20 and 21 having been newly added by the present amendment.

In the outstanding Office Action, Claims 15 and 18 were rejected under 35 U.S.C. § 103(a) as unpatentable over Vives ("Effects of Forced Electromagnetic Vibrations ..."); and Claims 15 and 18 were rejected under 35 U.S.C. § 103(a) as unpatentable over Radjai et al. ("Effects of Electromagnetic ...") in view of Vives.

Claim 15 has been amended and Claims 20 and 21 have been newly added herein. These amendment and additions in the claims are believed to find clear support in the specification, claims and drawings as originally filed. For example, amended Claim 15 and new Claims 20 and 21 are supported by page 12, lines 1-4 and lines 11-17, and page 14, lines 3-6, of the specification. Hence, no new matter is believed to be added thereby.

Before addressing the outstanding Office Action, a brief summary of Claim 15 as currently amended is believed to be helpful. Amended Claim 15 is directed to a method for shifting a refined microstructure of a metallic material and the method includes solidifying a molten metallic material at temperatures lower than a liquidus of the molten metallic material, applying an electric current and a magnetic field simultaneously to the solidifying metallic material to crush solid crystal particles of the solidifying metallic material into small pieces, and shifting the small pieces to a periphery of a cylindrical tube or container by alternating a magnetic field using an electromagnetic coil disposed such that the electromagnetic coil envelops the metallic material to yield said refined microstructure of the metallic material concentrated in the periphery portion of the cylindrical tube or container.

By shifting the small pieces as such, a molten phase, a solidifying phase and refined small pieces are separated into different portions and the refined small pieces are shifted to the periphery of the cylindrical tube or container in a specified controllable condition,[1] thereby enabling a continuous casting process to separate and output easily and continuously the refined metallic material from the metallic material in the molten and solidifying phases.

As discussed in the previous Response, Vives describes a study of effects of forced vibrations produced by two different electromagnetic force patterns during freezing of aluminum alloys, where simultaneous application of an oscillatory electric field and a steady magnetic field is used as electromagnetic force patterns.[2] However, Vives does not teach or suggest "shifting the small pieces to a periphery of a cylindrical tube or container *by alternating a magnetic field using an electromagnetic coil disposed such that the electromagnetic coil envelops the metallic material* to yield said refined microstructure of the metallic material concentrated in the periphery of the cylindrical tube or container" as recited in amended Claim 15 (emphasis added in italic). On the other hand, Vives shows in its Figure 3 electromagnetic bodies provided on only two sides of the rectangular pool, *i.e.*, they do not envelop the metallic material. As such, it is respectfully submitted that the Vives apparatus is different from that of Applicants and thus performs differently, thereby producing a different result. Furthermore, Vives states that in the presence of well-developed cavitation situations, a very fine and homogeneous structure has been observed throughout the ingot,[3] and does not state any shifting of a refined material to a periphery of a container or the refined material concentrated in an end portion of the metallic material. Therefore, the

[1] See Specification, page 10, lines 15-20.
[2] See Vives, column 3, line 60 to, column 4, line 18.
[3] Vives, the abstract.

subject matter recited in amended Claim 15 is believed to be patentably distinguishable from Vives.

Radjai discloses a study of an effect of electromagnetic vibrations induced by alternating electric and stationary magnetic fields on a solidified structure of Al-Si alloys, but does not teach or suggest "shifting the small pieces to a periphery of a cylindrical tube or container *by alternating a magnetic field using an electromagnetic coil disposed such that the electromagnetic coil envelops the metallic material* to yield said refined microstructure of the metallic material concentrated in the periphery of the cylindrical tube or container " as recited in amended Claim 15 (emphasis added in italic). More specifically, according to Radjai, application of any of the two fields alone had no significant effect on a microstructure of the alloys, and a significant effect was observed when the two fields were applied simultaneously,[4] and silicon particles are reduced in size by vibrations *at temperature higher than a liquidus* and agglomerated and repelled to an outer surface.[5] However, nowhere does Radjai disclose or suggest the shifting as recited in amended Claim 15. The subject matter recited in amended Claim 15 is therefore believed to be distinguishable from Radjai.

Because neither Vives nor Radjai discloses the shifting step as recited in amended Claim 1, even the combined teachings of these cited references are not believe to render the method recited in Claim 15 obvious.

For the foregoing reasons, Claim 15 is believed to be allowable. Furthermore, since Claims 18, 20 and 21 directly depend from Claim 15, substantially the same arguments set firth above apply to these dependent claims. Thus, Claims 18, 20 and 21 are also believed to be allowable.

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[4] See Radjai, lines 10-11.
[5] See id., lines 14-15.

In view of the amendments and discussions presented above, Applicants respectfully submit that the present application is believed to be in condition for allowance, and an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

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